wheel (from left to right in FIG. **32**A-**32**D), which is transmitted via the steering wheel to the driver as tactile vehicle steering information.

[0010] With this arrangement, however, since the wavy motion produced by the projections **505-508** using the tactile device **504** always travels in the same direction (radially outward direction of the steering wheel) regardless of the angular position (steering angle) of the steering wheel, a problem will occur in that when the steering wheel has been turned more than 90 degrees ahead of the neutral position, the traveling direction of the wavy motion relative to the turning direction of the vehicle **502** is reversed and this reversed condition will continue until the steering angle exceeds 270 degrees. Reversal of the relation-ship between the two movement directions would confuse the driver and hinders reliable perception of the tactile information by the driver.

SUMMARY OF THE INVENTION

[0011] It is accordingly a principal object of the present invention to provide a vehicle state information transmission apparatus, which is capable of transmitting vehicle state information including a warning to the driver in the form of tactile information well perceivable by the driver.

[0012] With the foregoing object in view, in one aspect the present invention provides a vehicle state information transmitting apparatus comprising: operation means actuatable by a driver of a vehicle for operating the vehicle; a vehicle state detecting device for detecting a state of the vehicle; warning means for issuing a warning to the driver based on information pertaining to the vehicle state detected by the vehicle state detecting device; and vehicle state information transmitting means for transmitting the information pertaining to the vehicle state detected by the vehicle state detecting device to the driver. The vehicle state information transmitting means comprises a tactile device, which transmits a change in the vehicle state via the operating means to the driver as tactile information, and the tactile device is operable in conjunction with the warning means.

[0013] With this arrangement, since the tactile device is operable in conjunction with the warning means, the vehicle state information representing a warning state of the vehicle is transmitted from the tactile device via the vehicle operating means to the driver as tactile information. With this tactile information transmission, the warning vehicle state information can be well perceived by driver with extremely high reliability even when the vehicle is traveling in loud environments with an audio device operating with full volume and/or the driver is a pregnant female which is freed from the obligation to drive with a seat belt securely fastened.

[0014] Preferably, the tactile device is capable of producing a movement of the tactility in different patterns that can be varied based on the information pertaining to the vehicle state detected by the vehicle state detecting device. By thus providing different tactile patterns, the vehicle state information can be transmitted to the driver with improved certainty.

[0015] The vehicle state detecting device preferably comprises a lane departure sensor for detecting a lane departure of the vehicle, and when the lane departure of the vehicle is detected by the lane departure sensor, the tactile device operates to issue a lane departure warning to the driver by way of the tactile information transmitted via the operation means to the driver. With this arrangement, information indicative of the vehicle traveling with a lane departure can be clearly perceived by the driver as tactile warning information provided in combination with a warning from the warning means.

[0016] In another aspect the invention provides a vehicle state information transmission apparatus comprising: operation means actuatable by a driver of a vehicle for operating the vehicle; a vehicle state detecting device for detecting a state of the vehicle; and vehicle state information transmitting means for transmitting the information pertaining to the vehicle state detected by the vehicle state detecting device to the driver. The vehicle state detecting device comprises a steering angle sensor for detecting a steering angle of a steering wheel of the vehicle, and the vehicle state information transmitting means comprises a tactile device which transmits a change in the vehicle state via the operating means to the driver as tactile information. The tactile device has a variable action pattern, which is variable with the progress of turning movement of the vehicle on the basis of information pertaining to the steering angle detected by the steering sensor.

[0017] With this arrangement, because the tactile device has a variable action pattern, which is variable with the progress of turning movement of the vehicle on the basis of information pertaining to the steering angle detected by the steering sensor, the information pertaining to the steering angle of the steering wheel can be clearly and reliably perceived at all times by the driver through the tactile information transmitted by the tactile device regardless of the steering angle, and more particularly even when the steering wheel is turned through an angle more than 90 degrees.

[0018] In still another aspect invention provides a vehicle state information transmission apparatus comprising: operation means actuatable by a driver of a vehicle for operating the vehicle; a vehicle state detecting device for detecting a state of a vehicle; and vehicle state information transmitting means for transmitting the information pertaining to the vehicle state detected by the vehicle state detecting device to the driver. The vehicle state detecting device comprises a travel direction sensor for detecting a travel direction of the vehicle, and the vehicle state information transmitting means comprises a tactile device which transmits a change in the vehicle state via the operating means to the driver as tactile information. The tactile device has a variable action pattern, which is variable in accordance with the travel direction of the vehicle on the basis of information pertaining to the travel direction detected by the travel direction sensor.

[0019] With this arrangement, since tactile device has a variable action pattern, which is variable in accordance with the travel direction of the vehicle on the basis of information pertaining to the travel direction detected by the travel direction sensor, the drive is allowed to perceive the tactile information indicative of the vehicle state even when the vehicle is traveling reverse. This will significantly improve the driving safety.

[0020] In yet another aspect the invention provides a vehicle state information transmission apparatus comprising: operation means actuatable by a driver of a vehicle for operating the vehicle; a vehicle state detecting device for detecting a state of the vehicle, the vehicle state detecting device comprising a parked vehicle sensor for detecting the vehicle while being in a parked state; and vehicle state information transmitting means for transmitting the information pertaining to the vehicle state detected by the vehicle state detecting device to the driver, wherein the vehicle state information transmitting means comprises a tactile device which transmits a